Appendix A
Lake Michigan LaMP Pollutant Discussion Paper - For Comment

Process of Identifying and Categorizing LaMP Pollutants

Lake Michigan LaMP 2000 announced that adaptive management of the Lake Michigan ecosystem would be the focus of the LaMP process. Public comments received on LaMP 2000 requested that the adaptive management approach be applied to the Lake Michigan LaMP pollutants list and that all stressors, not just chemicals, be considered.

This appendix identifies work performed by the Lake Michigan LaMP Toxics Reductions Subcommittee, consisting of Federal and State partners, to implement adaptive management of Lake Michigan pollutants since preparation of the Lake Michigan Lakewide Management Plan (LaMP) 2002 (see pages 89 to 95). This appendix is organized in two sections. The first section describes the process of identifying and categorizing LaMP pollutants. The second section applies the process by gathering available information to identify LaMP pollutants.

Comments on the process and pollutants are welcomed. This approach -- taken in the 2002 and 2004 Lake Michigan LaMPs to identifying critical pollutants, pollutants of concern, and a pollutant watch list – is innovative. The primary goal for pollutant categorization is to identify problem-causing chemicals that need management on a lakewide/basinwide, regional, or local basis, regardless of the type of action to be taken. The critical pollutant and pollutant of concern categories are heavily dependent on public health fish consumption advisories and state water quality standards because data are available for these programs. The pollutant watch list also relies on data from programs that identify water use problems in the Lake Michigan basin. In addition, the pollutant watch list includes chemicals without final national water quality criteria and/or state water quality standards. Candidates for the watch list, therefore, include conventional pollutants like nitrogen or ammonia as well as "emerging" pollutants without regulatory thresholds or action levels.

Background

In Lake Michigan LaMP 2002, the pollutant review process was depicted in Table A-1 (p. 91). The Federal and State partners have reviewed available information from the Great Lakes National Program Office, the Clean Water Act Section 303(d) lists submitted by States for 2002, participated in the 2003 International Association for Great Lakes Research conference, participated in the 2003 State of Lake Michigan conference, and completed a literature review. These are the actions identified in Table A-1 of LaMP 2002, with the exception of receiving and reviewing written comments on the 2002 LaMP. Comments received during preparation of the 2002 LaMP were considered before publication. One comment identifying a potential watch list pollutant was received on Appendix A. In addition, Federal and State partners participated in meetings including but not limited to: a [Persistent, Bioaccumulative, and Toxic Substances] PBT Monitoring Strategy Workshop in April-May 2002, an Endocrine Disruptors Program Review Workshop in October 2002; [Centers for Disease Control] CDC & U.S. EPA Meeting regarding Overview of CDC's Environmental Health Tracking Program in July 2003; a Region/ [Office of Research and Development] ORD Workshop on Emerging Pollutants in August 2003, and the 2004 National Forum on Contaminants in Fish. At the majority of these meetings, discussion of Lake Michigan LaMP pollutant identification was solicited, primarily with respect to the watch list pollutants. Despite this, some dissatisfaction remains with the process of identifying LaMP pollutants. This is described in the following paragraphs and in the outstanding issues sections below.

LaMP 2002's Background section of Appendix A identified several national efforts to improve the quality and comparability of states' Clean Water Act section 303(d) lists of impaired waters and section 305(b) reports of water quality for navigable waters. Identified weaknesses included the use of differences in systems used to identify geographic location, differences in report format from State-to-State, the lack of explicit linkage

between the data and categorization of the waters, and a lack of coordination between States with shared waters. For example, States use latitude-longitude, an arbitrary grid, location names, and hydrologic unit codes to identify fish sample collection locations and impaired waters stream segments. The differences between State 303(d) lists prevented inclusion of all States' information in Table A-4. Illinois' data are presented in this LaMP as an example. Water bodies identified in State 303(d) lists are identified in the watershed fact sheets in Appendix D of this document.

On July 21, 2003, U.S. EPA Headquarters' Office of Wetlands, Oceans, and Watersheds in the Office of Water issued *Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act*. EPA's goal continues to be the support of State monitoring programs that balance the ability to conduct broad scale analyses of water quality conditions with the monitoring necessary to make scientifically and statistically sound assessment determinations for specific waters. Of particular interest to this LaMP, EPA requires States to identify pollutants causing or expected to cause violations of the applicable water quality standards. These standards frequently include biological criteria.. States should identify all pollutants that are known to be causing the impairment of a water. Prior to establishing a TMDL, the pollutant causing a biological impairment would need to be identified.

Outstanding Issues - Critical Pollutants and Pollutants of Concern

After preparation of LaMP 2002, State and Federal staff re-examined use of the terms "open waters" and "near-shore waters." Both terms are used in the criteria for critical pollutants and pollutants of concern, and their definition is not clear. The regulatory definition of "open waters of the Great Lakes" in the Federal Water Quality Guidance for the Great Lakes (Title 40 of the Code of Federal Regulations [40 CFR], Part 132) is as follows: "all of the waters within ... Lake Michigan ... lakeward from a line drawn across the mouth of tributaries to the Lakes, including all waters enclosed by constructed breakwaters, but not including the connecting channels." In other words, the entire lake is open waters. According to the report from the State of the Lakes Ecosystem Conference in 1996, "the nearshore waters begin at the shoreline or the lakeward edge of the coastal wetlands and extend offshore to the deepest lake-bed depth contour, where the thermocline typically intersects with the lake bed in late summer or early fall." Lake Michigan is grouped, by the SOLEC 1996 report, with Lakes Huron, Erie, and Ontario as having nearshore waters between the shoreline and 27 meters (about 89 feet) depth. From discussion with Great Lakes researchers in 2003, the definition of nearshore waters is not formal. In summary, "open waters" may include both nearshore and offshore waters or only offshore waters.

Whether or not a particular pollutant is a Lake Michigan LaMP critical pollutant or a pollutant of concern depends largely on fish monitoring. This is because contaminant concentrations in the open waters are so low that a very large volume of water must be sampled in order to detect the target analyte. Concentrating the sample generates hazardous waste, making the analysis of open water relatively more expensive. As a result, States and EPA have not been routinely sampling and analyzing the open waters of Lake Michigan. States perform fish monitoring for natural resource management and in order to prepare public health sport fish consumption advisories. The EPA's Great Lakes National Program Office also performs monitoring for long term ecological trends and for contaminant trends in fish fillets because the fish bioaccumulate some target analytes. States use the contaminants detected through fish monitoring, along with other information, to assess whether a particular water body or segment is meeting its designated use. If contaminants are present in edible portions of fish above a risk-based threshold for human or animal consumption, the water body is identified as impaired.

As a practical matter, whether or not the open waters of Lake Michigan are impaired also depends in part on which definition of "open water" or "nearshore water" is used. Using the regulatory definition of open waters of the Great Lakes, the number of critical pollutants would

increase, perhaps including pathogens, nutrients, and sediment. Locally or regionally impaired waters that are a function of surface water or groundwater discharge of critical pollutants would be addressed using federally- imposed lakewide responses. Using the State of the Lakes Ecosystem Conference 1996 definition of nearshore waters and the location of sample collection to categorize a sample as representing nearshore or open water, the number of samples taken in open waters may be severely reduced. For example, the State of Michigan collects fish in the fall when they are swimming upstream to spawn. Relying on sample location to categorize these samples would result in identification of only pollutants of concern in Michigan since the rivers are landward of the shoreline or lakeward edge of coastal wetlands. Another available option is to try to categorize fish species into "open water" and "nearshore water" groups. Yet another option would be to define these terms on a pollutant-specific basis, as in the preparation of

TABLE A-1. The fish species identified below are included in the State of Michigan Fish Consumption Advisory for the Lake Michigan Watershed.

Fish Species	Normally found in Open Waters	Normally found in Nearshore Waters	Normally found in Inland Waters
Brown Trout	X	X	
Carp		X	
Catfish			
Chinook Salmon	X	X	
Lake Trout	X		
Rainbow Trout (including Steelhead)	X		
Smelt	X		
Sturgeon			
Walleye			
Whitefish	X		
Yellow Perch	X	X	
Burbot	X		
Channel Catfish			
Longnose Sucker		X	
Northern Pike		X	
Smallmouth Bass		X	
White Perch			
White Sucker		X	
Largemouth Bass		X	
Rock Bass		X	
Redhorse Sucker			
Catfish			
Suckers			
Black Crappie		X	
Bluegill		X	
Yellow Bullhead		X	
Crappie		X	
Muskellunge			

TABLE A-2. The U.S. Environmental Protection Agency's Great Lakes National Program Office conducts whole fish monitoring to track ecosystem changes and fish filet monitoring for the trend of contaminants in sport fish.

Study component	Lake	Species	Size Range (mm)	Number of fish	Number of composites	Sample type
Open Lakes Monitoring	Michigan, Huron, Superior, Ontario	Salvelinus namaycush (lake trout)	600 to 700	50	10	Whole fish
	Erie	Stizostedion vitreum (walleye)	450 to 550	50	10	Whole fish
Sport Fish	Michigan, Huron, Superior, Ontario	Oncorhynchus kisutch (Coho Salmon) and Oncorhynchus tshawytscha (Chinook salmon) and	3 years of age Coho 4-5 years of age Chinook	15	3	Filet (skin-on)
	Erie	Salmo gairdneri (Rainbow trout)	600 to 700	15	3	Filet (skin-on)

TMDLs for reaches of streams.

State and federal staff asked biologists whether fish could be assigned into geographic categories such as: "normally found in open waters" or "normally found in nearshore waters." All biologists contacted rejected the notion because fish spend various life stages in more than one environment. Nonetheless, a member of the Great Lakes Fishery Commission filled in portions of the table supplied by state of Michigan staff (Table A-1). This table will be updated to include Lake Michigan fish identified in each state's fish consumption advisory for Lake Michigan. The LaMP may rely on the fishery categories because of the variation in metadata available for state fish contaminant monitoring programs. In addition, the Great Lakes National Program Office's fish monitoring program relies on single species trends and selected species because studies of stomach contents have shown the harvested fishes' diet to represent the open waters. See Table A-2. The Lake Michigan LaMP 2004 relies upon State-collected data for the period from 2000 to the present and other sources. In LaMP 2004, we continue to rely upon the criteria proposed to identify Lake Michigan LaMP critical pollutants and pollutants of concern in LaMP 2002.

Any one of these four criteria may be relied upon to define the Lake Michigan LaMP critical pollutants:

- Pollutants identified on Illinois, Indiana, Michigan, or Wisconsin Clean Water Act Section 303(d) lists or in Section 305(b) reports as sources of impairment to the open waters of the lake;
- Pollutants that have been found to exceed Great Lakes Water Quality Initiative (GLI) water quality criteria in the open waters of the lake;
- Pollutants that exceed or trigger a relevant Action Level, such as a fish consumption advisory (FCA) or a maximum contaminant level (MCL), in the open waters of the lake; or,
- Pollutants associated with other lakewide designated use impairments (e.g., impairment to aquatic life).

We continue to seek comment regarding whether hazardous constituents or substances detected in releases from Resource Conservation and Recovery Act installations or from Superfund sites should be considered an Agency action level for purposes of defining critical pollutants. We note that the Office of Wetlands, Oceans, and Watersheds' July 21, 2003 guidance for assessment, listing and reporting requirements identifies Superfund Records of Decision as a source of information and data to be considered.

Federal and State partners also seek comment regarding how contaminants detected in humans should be classified.

Any one of the following three criteria are proposed to define Lake Michigan LaMP pollutants of concern:
•Pollutants on State 303(d) lists identified as causing impairments in nearshore waters and Lake Michigan tributary mouths;
•Pollutants exceeding an Agency action level in nearshore waters or tributary mouths, including pollutants identified as a source of impairment in a Great Lakes Area of Concern; or
•Pollutants associated with regional use impairments (e.g., impairment of local fish communities or populations).

Between LaMP 2004 and LaMP 2006, we will examine the metadata from State and Federal fish monitoring programs in several scenarios. In the first scenario, we will rely on the Federal Water Quality Guidance definition of open waters of the Great Lakes and evaluate impairments as Lake Michigan or not Lake Michigan (i.e., Area of Concern); load reduction targets and total maximum daily loads would be calculated for the entire Lake. In the second scenario, we will attempt to apply the State of the Lakes Ecosystem Conference 1996 definition of nearshore waters; this would be consistent with dividing Lake Michigan into zones for calculating a total maximum daily load. In the third scenario, fish consumption advisories would be categorized by fish species into "open water" and "nearshore water" groups; this may also result in dividing Lake Michigan into zones. A fourth scenario might consist of identifying "open water" and "nearshore water" impairments by pollutant. For example, *E. coli* exceedances could be addressed through a TMDL for a geographically discrete nearshore zone.

Outstanding Issues – Watch List

In LaMP 2004, two general categories of information were reviewed to identify candidates for the watch list. First, we relied on the 303(d) lists to identify pollutants *upstream* of the tributary mouth. These upstream pollutants may include the LaMP critical pollutants and pollutants of concern, but such pollutants are not repeated on the watch list. The watch list candidates from the 303(d) lists may eventually become pollutants of concern or critical pollutants if their geographic distribution extends to the tributary mouth or lake. Second, we are identifying chemicals without relevant water quality criteria as watch list candidates if they qualify using the three criteria proposed in LaMP 2002. The three biggest process issues for identification of the watch list pollutants are: availability of analytical methods and reference standards; selecting chemicals to look for; and, the lack of toxicological information. In the following paragraphs of this section, these process issues will be examined one-by-one.

Environmental chemical analyses typically identify target analytes, tentatively identified compounds, recognizable artifacts, and the sample's relatively large proportion of naturally occurring and anthropogenic chemicals of varied toxicity. Each of these groups of chemicals varies in toxicity from high to low. The target analytes are those that can be identified with off-the-shelf chemical analysis technology and were identified, for the most part, in the 1970s. The regulatory target analytes were not selected based on toxicity (C.G. Daughton, U.S. EPA, July 2002). Finally, reference analytical standards are typically not commercially available for proprietary products, with exceptions such as the PCB congener composition of various Arochlor mixtures.

How does one select a chemical for detection in the environment? The possibilities seem endless because practically everything that we use will end up in the environment at some concentration. One approach would be to rank chemicals in order of volume produced. Chemicals produced in annual volumes above 1 million pounds are considered High Production Volume or "HPV" chemicals. This subset of 3,000-4,000 HPV chemicals is the main focus of EPA's Office of Pollution, Prevention, and Toxic's Existing Chemicals Data Collection and Data Development (Testing) activities. Data on chemicals that are collected or developed are made accessible to the public and are intended to provide input for efforts to evaluate potential risk from exposures to these chemicals (accessed 02/17/2004). The identification of 3,000 to 4,000

HPV chemicals narrows down the selection of a chemical for research a bit, but not quite enough to design an affordable monitoring program. Other ideas for identifying watch list pollutants include: testing for pharmaceuticals and personal care products; testing for disinfection by-products; following the European lead; and, testing environmental samples for constituents from recycling activities.

The universe of chemicals of concern to EPA as potential endocrine disruptors is estimated to number more than 87,000 items including: pesticides, commercial chemicals, cosmetic ingredients, food additives, nutritional supplements, and certain mixtures. Some Lake Michigan LaMP 2004 critical pollutants are among the reference chemicals used to develop standard test methods to identify endocrine disruptors. This is because they produced a well-documented positive response in one or more Tier 1 screening assays by an identified mode of action. Some chemicals may act by more than one mode of action. The standard test methods being developed include Tier 1 and Tier 2 assays targeting modes of action including: androgen, antiandrogen, estrogen, antiestrogen, hypothalmic-pituitary-gonadal axis, steroidogenesis, aromatase, and thyroid.

The Endocrine Disruptor Program is one of several ways the EPA attempts to identify toxic threats to human health and the environment. The Agency for Toxic Substances and Disease Registry (ATSDR) and the EPA prepare a list, in order of priority, of substances that are most commonly found at facilities on the Comprehensive Emergency Response Cleanup and Liability Act (CERCLA or Superfund) National Priorities List and which are determined to pose the most significant potential threat to human health due to their known or suspected toxicity and potential for human exposure at the National Priorities List sites. This list of substances is known as the CERCLA list. It provides guidance in selecting which substances will be the subject of toxicological profiles prepared by ATSDR. Another example is the TSCA Interagency Testing Committee (ITC). In 1976, under the Toxic Substances Control Act (TSCA), the U.S. Congress created the TSCA Interagency Testing Committee (ITC) as an independent advisory committee to the Administrator of the U.S. EPA. The ITC includes 16 U.S. Government Member organizations. The ITC was created to identify chemicals regulated by TSCA for which there are suspicions of toxicity or exposure and for which there are few, if any, ecological effects, environmental fate or health effects testing data. As mandated under section 4(e) of TSCA, the ITC must add these chemicals to the Priority Testing List and recommend them for testing or information reporting in May and November Reports to the Administrator. Chemicals are recommended for testing to meet the data needs of the ITC's 16 U.S. Government Member organizations. The ITC encourages producers and importers of recommended chemicals to voluntarily submit studies to meet these U.S. Government data needs. Since its first meeting on February 5, 1977, the ITC has reviewed thousands of chemicals.

In summary, the outstanding issues surrounding identification of watch list pollutants are much bigger than the Lake Michigan Basin. We will continue to use all three of the criteria proposed in 2002 for Lake Michigan LaMP watch list pollutant identification:

- potential to impact the Lake Michigan ecosystem;
- presence in the Lake Michigan watershed; and,
- bioaccumulation potential, persistence in water or sediment, or toxicity singly or through synergistic effects.

No comments were received on these criteria following LaMP 2002 publication.

LaMP Pollutants

Due to the timing of LaMP publication and the EPA due date for States' Clean Water Act Section 303(d) lists, the identification of critical pollutants and pollutants of concern is delayed. Section 303 (d) of the Clean Water Act requires states to prepare lists of waters within its boundaries that do meet or are threatened to not meet water quality standards applicable to such waters. These lists are due on April 1 of every even-numbered year. The target release date for the LaMPs is Earth Day, April 22 of even numbered

Table A-3. Status of LaMP Pollutants Proposed in LaMP 2002

	Lake Michigan LaMP Pollutants Proposed in LaMP 2002	Lake Michigan LaMP Pollutants Final in LaMP 2004
Critical Pollutants	PCBs, chlordane, DDT/DDE, mercury, dioxin	PCBs, chlordane, DDT/DDE, mercury, dioxin
Pollutants of Concern	PAHs, lead, cadmium, chromium, copper, zinc, arsenic, cyanide, endrin, heptachlor epoxide, lindane, nickel, nutrients, pathogens, sediments	PAHs, lead, cadmium, chromium, copper, zinc, arsenic, cyanide, endrin, heptachlor epoxide, lindane, nickel, nutrients, pathogens, sediments
Pollutant Watch List	atrazine, selenium, PCB substitute compounds	atrazine, selenium, PCB substitute compounds

years. At the time of LaMP 2004 preparation, the most recent federally approved CWA 303(d) lists were submitted in 2002.

LaMP Pollutants Proposed in 2002

Critical Pollutants

In LaMP 2002, federal and state partners proposed to identify polychlorinated biphenyls, chlordane, DDT/DDE (DDT and metabolites), mercury, and dioxin as LaMP critical pollutants. This proposal was based on the presence of these chemicals on state public health fish consumption advisories (an "action level exceedance") for the open waters of Lake Michigan and on state 303(d) lists. As no adverse comments were received, these pollutants are final critical pollutants in this LaMP 2004. See Table A-3.

Pollutants of Concern

Also in LaMP 2002, federal and state partners proposed to identify dieldrin, polycyclic aromatic hydrocarbons (PAHs), lead, cadmium, chromium, copper, zinc, arsenic, cyanide, endrin, heptachlor epoxide, lindane, nickel, nutrients, and pathogens (includes bacteria, parasites, and viruses) as pollutants of concern. These substances are identified as causes of impairment for nearshore waters and tributary mouths. Sediments are also identified as a cause of impairment in the Lake Michigan Impairments Summary, a geographic information systems map on p. 93 of LaMP 2002. State and federal staff applied judgement in determining which waters are nearshore waters and tributary mouths. As no adverse comments were received, these pollutants are final pollutants of concern. See Table A-3.

Watch List Pollutants

In LaMP 2002, we did not propose any new watch list pollutants. We anticipated receiving comments on the watch list criteria, and this did not happen. The same watch list pollutants from LaMP 2002 are carried over into LaMP 2004 as final. See Table A-3. Comments on the process for identifying candidate pollutants for the watch list are still invited.

LaMP Pollutants Proposed for Finalization in 2006

As stated in the introduction to this appendix, LaMP 2004 uses the same criteria to identify proposed pollutants as the criteria proposed in LaMP 2002.

Critical Pollutants

These pollutants still exceed at least one state's public health fish consumption advisories for Lake Michigan and Green Bay: PCBs, mercury, DDT, chlordane, and dioxin.

- In Illinois, the 2004 Lake Michigan fish advisory is for chlordane and PCBs in Chinook Salmon, Coho Salmon, Lake Whitefish, Rainbow Trout, Brown Trout, Lake Trout, Yellow Perch, Smelt, Channel Catfish, and Carp.

- In Indiana, the 2003 Lake Michigan fish consumption advisory is for mercury and/or PCBs in Black Crappie, Bloater, Bluegill, Brook Trout, Brown Trout, Carp, Channel Catfish, Chinook Salmon, Coho Salmon, Freshwater Drum, Lake Trout, Lake Whitefish, Largemouth Bass, Longnose Sucker, Northern Pike, Pink Salmon, Quillback, Rainbow Trout, Rock Bass, Round Goby, Silver Redhorse, Smallmouth Bass, Walleye, White Sucker, and Yellow Perch. See the advisory for location-specific guidelines.

- In Michigan, the Lake Michigan fish consumption guide is for PCBs, Chlordane, Mercury, Dioxin, and/or DDT in Brown Trout, Burbot, Carp, Catfish, Channel Catfish, Chinook Salmon, Coho Salmon, Lake Trout, Longnose Sucker, Northern Pike, Rainbow Trout (including Steelhead), Smallmouth Bass, Smelt, Splake, Sturgeon, Walleye, White Bass, Whitefish, White Perch, White Sucker, and Yellow Perch. See the guide for location-specific guidelines

- The 2003 Health Guide for Eating Fish in Wisconsin identifies Green Bay south of Marinette for PCBs and other chemicals in Northern Pike, Walleye, White Bass, Yellow Perch, Carp, White Perch, Smallmouth Bass, Channel Catfish, White Sucker, Rainbow Trout, Chinook Salmon, Whitefish, Splake, Brown Trout, and Sturgeon. The 2003 Health Guide for Eating Fish in Wisconsin identifies Lake Michigan for PCBs and other chemicals in Chinook Salmon, Coho Salmon, Brown Trout, Lake Trout, Rainbow Trout, Yellow Perch, Whitefish, Chubs, and Smelt. See the Guide for location-specific guidelines.

All Lake Michigan states' consumption advisories do not identify every chemical detected in fish monitoring programs. For example, Wisconsin believes that the advisory for PCBs protects consumers from PCBs and additional chemicals.

In addition to the fish consumption advisories, Illinois identified the use of Lake Michigan as a drinking water source as threatened due to priority organics and PCBs in its 2002 303(d) list. Indiana identified the use of Lake Michigan shorelines as impaired due to pathogens, as well as PCBs and mercury in places, in its 2002 303(d) list. PCBs, mercury, DDT and metabolites, chlordane, dioxin, pathogens, and priority organics are proposed Critical Pollutants for finalization in LaMP 2006.

Pollutants of Concern

The pollutants in Table A-4 for Illinois and in other states' 2002 303(d) lists are identified as the cause of impairments. In addition to the pollutants listed in text below, the critical pollutants were also detected in some stream segments discharging to Lake Michigan. States have prepared their 303 (d) lists for federal approval in 2004 and they have a few changes primarily due to clerical error.

- In Illinois, the water body segments discharging into Lake Michigan are impaired due to siltation, organic enrichment/low dissolved oxygen (DO), priority organics, nutrients, phosphorus, pathogens, metals, arsenic, cadmium, copper, chromium, lead, zinc, nitrogen, total (nitrates + total Kjehldal nitrogen), salinity/total dissolved solids (TDS)/ chlorides, and TDS (conductivity).

- In Indiana, the water body segments discharging to Lake Michigan are impaired due to critical pollutants plus pathogens (E. Coli) and impaired biotic communities (i.e., the possibility of a pollutant causing the impairment has not been eliminated).

- In Michigan, the water body segments discharging into Lake Michigan are impaired due to critical pollutants as well as nutrients and pathogens.

- In Wisconsin, the water body segments discharging into Lake Michigan are impaired due to critical pollutants plus nutrients, sediments, arsenic, and metals (chromium, copper, lead, and zinc).

Potential Watch list pollutants

The pollutants in Table A-4 for Illinois and in other states' Federally approved 2002 303(d) lists are identified as the cause of impairments. Watch list pollutants were detected in the tributary segments *upstream* of the segment discharging to Lake Michigan and therefore do not qualify as LaMP critical pollutants or pollutants of concern. The states' 303(d) lists document these pollutants' presence in the Lake Michigan watershed. These

303(d)-listed pollutants are subject to regulation under the Clean Water Act for their potential to impact the Lake Michigan ecosystem. Their bioaccumulation potential, persistence in water or sediment, or toxicity singly or through synergistic effects remains to be evaluated. In addition to the watch list pollutants listed below, the critical pollutants and pollutants of concern were also detected in some upstream segments. Water body segments upstream of the segment discharging to Lake Michigan are impaired due, in part, to these pollutants: suspended solids, cyanide, other inorganics (fluoride), total ammonia-N, nitrates, ammonia (unionized), total ammonia-N, inorganic-N, low DO, chlorides, salinity/TDS, siltation, impaired biotic communities (potentially caused by a pollutant), and oil and grease. All of these pollutants may not meet the watch list criteria proposed in 2002.

In addition to reviewing 303(d) lists, state and federal staff learned of additional candidates for

TABLE A-4. Illinois 303(d)-listed waters in the Lake Michigan and Calumet River Watershed. The first column identifies the water body by name and by Illinois code. The second column identifies the water body's designated use(s) and the status of that use. Status terms include Full (best), Threatened, Partial Support, Nonsupport (worst), and Not Assessed. The third column identifies the causes of impaired uses along with a confidence level code: H for confidence level 3, M for confidence level 2, S for confidence level 1, and T for no confidence level assigned. DO stands for Dissolved Oxygen.

Illinois Water Body	Status/Designated Use	Impairment Causes (2002)
Lake Michigan Open Water	Full overall use, full use aquatic life, nonsupport fish consumption, full primary contact, full secondary contact (recreation), full/threatened drinking water supply*	M priority organics, H PCBs
Lake Michigan Waukegan Harbor	Non-support Overall Use, Non-support Aquatic Life, Non-support Fish Consumption, Primary Contact (swimming) not assessed, Secondary Contact (recreation) not assessed	H PCBs, M metals, M arsenic, M cadmium, M copper, M chromium, M lead, M zinc, S nutrients, S phosphorus, Nitrogen, total (nitrates + TKN)
Lake Michigan (Great Lakes NTC, Wilmette, Chicago, & Calumet Harbors)	Overall use not assessed, Aquatic Life not assessed, Nonsupport Fish Consumption, Primary Contact (swimming) not assessed, Secondary Contact (recreation) not assessed	H PCBs
Lake Michigan Beaches (12)	Partial Primary Contact	H pathogens
Lake Michigan Beaches (18)	Non-support Primary Contact	H pathogens
Pettibone Cr. QA C4	Partial overall use, Partial support Aquatic Life	Habitat alteration (not flow), Priority organics, PCBs, Metals, Arsenic, Copper, Mercury, Zinc
Waukegan R. QC 03	Partial overall use, Partial support Aquatic Life	Salinity/TDS/chlorides, TDS (conductivity), Habitat alteration (not flow), Priority organics, PCBs
Waukegan R. QC 05	Partial overall use, Partial support Aquatic Life	Salinity/TDS/chlorides, TDS (conductivity), Priority organics, PCBs
S. Br. Waukegan R. QCA 01	Partial overall use, Partial support Aquatic Life	Salinity/TDS/chlorides, TDS (conductivity), Priority organics, Nutrients, Phosphorus, Total ammonia-N
S. Br. Pettibone Cr. QAA D1	Partial overall use, Partial support Aquatic Life	Priority organics, PCBs

* One sample event from the City of Chicago showed Phenols and the need to re-sample with the possibility of re-classifying the status. Follow-up Source Water Assessment works confirms "full use" status which is reflected in the IEPA 2004 303(d) draft list currently on-line for review.

the watch list by attending conferences and reviewing scientific literature. These candidates include: nonylphenol, alkylphenol polyethoxylates, and alkyl phenol and ethoxylates (APEs); polybrominated diphenyl ethers (PBDEs); polychlorinated naphthalenes; perfluorooctyl sulfonate (PFOS); asbestos; specific polycyclic aromatic hydrocarbons (PAHs); thallium, selenium, phthalates, atrazine, herbicides, personal care products, and pharmaceuticals, hormones, and other organic wastewater contaminants; radioactive material; synthetic musks; toxaphene; sulfur; 1-naphthol and 2-naphthol. Many more journal articles were located than could be reviewed in time for preparation of this LaMP. In order to determine whether these chemicals qualify as watch list pollutants, Table A-5. below should be completed. All three watch list criteria listed in Table A-5 must be met in order for a pollutant to be finalized in 2006 as a watch list pollutant.

In addition to the potential watch list pollutants identified thus far, additional pollutants may be identified under a Safe Drinking Water Ac t program. The Safe Drinking Water Act federal program implements an Unregulated Contaminant Monitoring Regulation for Public Water Supply. On October 29, 2002, analytical methods for chemical and mcrobiological contaminants were published as a final rule (67 FR 65888). This program was not

TABLE A-5. Evaluation of Potential Watch List Pollutants using Watch List Criteria.

Pollutant	Potential to Impact Lake Michigan Watershed	Presence in Lake Michigan Watershed	Bioaccumulation potential; persistence in water or sediment; or toxicity singly or through synergistic effects
Alkylphenol ethoxylates (APES) and degradation products (used in industrial detergents)	Yes		01/05/2004 Notice of Availability of Draft Aquatic Life Criteria Document for Nonylphenol and Request for Scientific Views, 69 FR 340
polybrominated diphenylether (PBDE) (flame retardant used in fabrics and plastics)	Yes	Environmental Science and Technology 35(6) 1072-1077 2001 "Comparison of Polybrominated Diphenyl Ethers (PBDEs) and Polychlorinated Biphenyls (PCBs) in Lake Michigan Salmonids" by Manchester-Neesvig, J.B. et al.	Yes - Dioxin 2003 (peer reviewed?). Suspected to affect thyroid function (ATSDR).
polychlorinated naphthalenes (PCN)	Yes	Environmental Science and Technology 2000 34(4) 566-572 "Polychlorinated Naphthalenes and Polychlorinated Biphenyls in Fishes from Michigan Waters Including the Great Lakes" by Kannan, K. et al	yes (e.g., Appendix VIII to 40 CFR Part 261–Hazardous Constituents)
perfluorooctane sulfonate (PFOS) & its salts (spray on fabric protectors)	yes		TSCA SNUR for 8-carbon chain cmpds. OECD PFOS hazard assessment

TABLE A-5, continued. Evaluation of Potential Watch List Pollutants using Watch List Criteria.

Pollutant	Potential to Impact Lake Michigan Watershed	Presence in Lake Michigan Watershed	Bioaccumulation potential; persistence in water or sediment; or toxicity singly or through synergistic effects
asbestos (flame resistant mineral)	Yes (people/ animals)	Yes (reference for LM beach in Illinois)	Yes - human carcinogen IRIS
specific polycyclic aromatic hydrocarbons (PAH) (a family of chemicals produced by incomplete combustion)	yes Atmospheric Environment 33 (1999) 5071-5079 "Source apportionment and source/sink relationships of PAHs in the coastal atmosphere of Chicago and Lake Michigan" by Matt Simcik et al.	acenaphthylene, acenaphthene, fluorene, 1 methyl-fluorene, phenanthrene, anthracene, 2- methylphenanthrene, fluoranthene, pyrene, retene, benzo(a)fluorene, benzo(b)fluorene, benz(a) anthracene, chrysene, benzo(b +k) fluoranthene, benzo(e)pyrene, benzo(a) pyrene, perylene, indeno (c,d)pyrene, diben(ah) anthracene, benzo(ghi) perylene, antanthrene, and coronene	D[1] RfD[2], NOAEL[3] D, RfD D D, RfD D, RfD D, NOAEL B2[4] B2 D, RfD B2 B2 B2 D
thallium (natural heavy metal released through coal burning and smelting)	Yes	T.S. Lin et al. 2001. "Thallium Concentration in Lake Trout from Lake Michigan." Bull. Environ. Contam. Toxicology, 67, 921-925.	IRIS: Tl compds. D with RfDs human health water quality criteria (CWA)

[1] "D" means that human carcinogenicity was not classifiable.

[2] "RfD" is an oral reference dose.

[3] "NOAEL" is the no observed adverse effects level.

TABLE A-5, continued. Evaluation of Potential Watch List Pollutants using Watch List Criteria.

Pollutant	Potential to Impact Lake Michigan Watershed	Presence in Lake Michigan Watershed	Bioaccumulation potential; persistence in water or sediment; or toxicity singly or through synergistic effects
selenium **(Se compounds in IRIS) (natural heavy metal)**	Yes	Food and Drug Administration-approved additive in animal feed and human dietary supplements	IRIS: D, RfD
phthalates (plasticizer)			water quality criteria for select phthalates 65 FR 66443. A National Academy of Sciences panel studied hormone-disrupting contaminants and said in its 1999 report that phthalates can cause health problems in humans and wildlife including birth defects and reproductive disorders.
radioactive material	yes	yes (e.g., nuclear waste)	yes - Chernobyl examples
synthetic musks: **six polycyclic musks (AHTN, HHCB, ATII, ADBI, AHMI, & DPMI) and two nitro musks (musk xylene and musk ketone) (used in personal care products)**	yes	Aaron Peck and Keri Hornbuckle, "Synthetic Musk Fragrances in Lake Michigan" Environmental Science & Technology, 2004, vol. 38, pp. 367-372.	
toxaphene (cancelled pesticide)	yes	ES&T 2001 35(16); 3287-3293. Accumulation of Atmospheric and Sedimentary PCBs and Toxaphene in a Lake Michigan Food Web	yes
sulfur (atmospheric) (natural element)	yes	Environmental and Experimental Botany Volume 36, Issue 3, October 1996, Pages 255 - 259 "Element concentrations in the lichen Hypogymnia physodes (L.) Nyl. after 3 years of transplanting along Lake Michigan" by James P. Bennett et al.	Environmental and Experimental Botany Volume 36, Issue 3, October 1996, Pages 255 - 259 "Element concentrations in the lichen Hypogymnia physodes (L.) Nyl. after 3 years of transplanting along Lake Michigan" by James P. Bennett et al.

TABLE A-5, continued. Evaluation of Potential Watch List Pollutants using Watch List Criteria.

Pollutant	Potential to Impact Lake Michigan Watershed	Presence in Lake Michigan Watershed	Bioaccumulation potential; persistence in water or sediment; or toxicity singly or through synergistic effects
atrazine (current use pesticide)	yes	GLNPO's Lake Michigan Mass Balance study	"Ambient Aquatic Life Water Quality Criteria for Atrazine - Revised Draft" (EPA-822-R-03-023)
herbicides (used on major crops such as corn and soybeans to kill weeds)	Detected in the Root River at Racine:	atrazine, deethyl-atrazine, deisopropylatrazine (and OEAT), acetochlor ESA, acetochlor OXA, acetochlor ESA, dimethenamid ESA, metolachlor ESA, metolachlor OXA, didealkylatrazine (CAAT), hydroxyatrazine (OIET), glyphosate, aminomethylphosphonic acid (AMPA) USGS Open File Report 03-217 Reconnaissance Data for Glyphosate, Other Selected Herbicides, Their Degradation Products, and Antibiotics in 51 Streams in Nine Midwestern States, 2002 by E. Scribner et al.	atrazine & degradation products acetochlor & degradation products metolachlor & degradation products glyphosate & degradation products Herbicides above are regulated by FIFRA during pesticide use. SDWA would regulate for public water supply. See the State Management Plan proposed rule.
wastewater-related	yes	1,4-dichlorobenzene (deodorizer); 2,6-di-tert-butylphenol, 2,6-di-tert-p-benzoquinone, Butylated hydroxy toluene (previous 3 antioxidants); Tri (2-chloroethyl) phosphate, tri (2-chloroethyl) phosphate (previous 2 fire retardants) 4-methyl phenol (disinfectant)	
personal care products	yes		
pharmaceuticals	yes	Cimetidine (antacid) Trimethoprim (antibiotic) Lincomycin (antibiotic)	
hormones	Yes	cholesterol (plant/animal steroid) coprostanol (fecal steroid)	

TABLE A-6. Proposed Lake Michigan Critical Pollutants and Pollutants of Concern for Finalization in LaMP 2006.

Pollutant Classification	Pollutants Proposed in 2004 for finalization in LaMP 2006
Critical Pollutants	PCBs, mercury, DDT and metabolites, chlordane, dioxin, and priority organics
Pollutants of Concern	siltation, sediments, organic enrichment/low dissolved oxygen (DO), nutrients, phosphorus, pathogens (E.Coli, Cryptosporidium, Giardia, Salmonella), metals, arsenic, cadmium, copper, chromium, lead, zinc, mercury, nitrogen, total (nitrates + total Kjehldal nitrogen), salinity/total dissolved solids (TDS)/chlorides, and TDS (conductivity), impaired biotic communities (i.e., the possibility of a pollutant causing the impairment has not been eliminated).

TABLE A-7. Pollutants Identified in 2004 for Proposed LaMP 2006 Watch List.

Watch List	
	PBDEs, PCNs, PFOS, asbestos, PAHs (acenaphthylene, acenaphthene, fluorene, 1 methyl-fluorene, phenanthrene, anthracene, 2-methylphenanthrene, fluoranthene, pyrene, retene, benzo(a)fluorene, benzo(b)fluorene, benz(a) anthracene, chrysene, benzo(b +k) fluoranthene, benzo(e)pyrene, benzo(a)pyrene, perylene, indeno (c,d)pyrene, diben(ah)anthracene, benzo(ghi)perylene, antanthrene, and coronene), thallium, selenium, phthalates, radioactive material, synthetic musks: six polycyclic musks (AHTN, HHCB, ATII, ADBI, AHMI, & DPMI) and two nitro musks (musk xylene and musk ketone), toxaphene, sulfur, atrazine & degradation products , metolachlor & degradation products, acetochlor & degradation products, glyphosate & degradation products, 1,4-dichlorobenzene, 2,6-di-tert-butylphenol, 2,6-di-tert-p-benzoquinone, butylated hydroxy toluene, tri (2-chloroethyl) phosphate, tri (2-chloroethyl) phosphate, 4-methyl phenol, cimetidine, trimethoprim, lincomycin, cholesterol, coprostanol, 1-naphthol, 2-naphthol

reviewed in time for publication of this document. If any unregulated contaminants were detected in the Lake Michigan Basin prior to 2004, these will be considered to have been proposed here as watch list pollutants in 2004.

In summary, the Lake Michigan LaMP critical pollutants have changed by inclusion of priority organics, and this is the first time for the Lake Michigan LaMP to acknowledge a State's identification of a threatened drinking water supply impairment for Lake Michigan. The pollutants of concern list has broadened to include conventional pollutants that are not a single chemical, as shown in Table A-6. The potential watch list presented in Table A-7 incorporates new information from the State-prepared 303(d) lists and research.

'PCB substitute compounds' are no longer proposed; however, some of the potential watch list pollutants serve a similar function as PCBs do. That is, PCBs are used as a dielectric fluid in high temperature applications that require fire retardants.

Summary and Request for Comments

In closing, LaMP pollutants could be categorized in many different ways. The current scheme is based on geographic extent of the impairment because a lakewide solution for a local impairment doesn't make sense. On the other hand, widespread watch list pollutants might be prevented from becoming critical pollutants through lake watershed-wide adaptive management. Upon preparation of this update to the pollutant lists, it seems that pollutants within each category may be targeted for different activities. For the critical pollutants, regulatory actions have already been taken, and additional regulatory actions might be needed. For the pollutants of concern, source track-down and reduction may be appropriate. For the watch list, additional toxicological work may be appropriate before developing a regulatory approach. Grouping pollutants into categories of need for monitoring, regulated, not regulated and identification of potentially appropriate steps for each pollutant would be a helpful analysis. There are not sufficient resources to complete this task prior to publication of LaMP 2004, but this analysis is offered to aid discussion of this important issue.

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